

PERIOD DETERMINATION FOR 161 ATHOR

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New observations at Organ Mesa and Hunters Hill Observatories 2008 March and April show that 161 Athor has a synodic period of 7.281 ± 0.001 h and, during that time, a monomodal lightcurve with amplitude of 0.08 ± 0.02 magnitudes. An approximate pole position is also reported.

Frederick Pilcher and David Higgins each independently targeted 161 Athor in 2008 March. Higgins listed his observations on the CALL website in late March, and the two authors subsequently agreed to combine their observations in a collaborative paper.

Pilcher's observations were made with a Meade 35-cm LX200 GPS Schmidt-Cassegrain (SCT), SBIG STL 1001-E CCD, clear filter, and unguided. Higgins observed with a 0.36-m SCT fitted with a Meade f/3.3 focal reducer and SBIG ST-8E CCD at f/4, clear filter, and guided exposures. For both observers differential photometry and lightcurve analysis were done with *MPO Canopus*, which enabled sharing and linking of data by both observers. The instrumental magnitudes of the combined sessions were freely adjusted to provide the best fit.

Three previous lightcurves have been published. Debehogne and Zappala (1980) obtained the most dense data set on four nights, 1979 Apr. 30-May 4 at longitude 239 degrees, obtaining a bimodal lightcurve with period of 7.288 h, amplitude 0.27 mag, and full phase coverage with one minimum twice as deep as the other. Carlsson and Lagerkvist (1983) observed on five nights, 1982 Mar. 20-24, at longitude 153 degrees. They did not obtain a unique period determination but were able to phase their observations both to 7.288 h with a monomodal lightcurve and to 0.454 d (10.90 h) with a bimodal lightcurve of 0.08 mag amplitude. Harris and Young (1989) obtained 15 data points on 1980 Nov. 6, 16, and Dec. 15 at longitudes 59-52 degrees, which are consistent with a 7.288 h period and extreme range 0.25 mag with only 60% of the full lightcurve covered.

Pilcher and Higgins each obtained lightcurves on seven nights within the interval 2008 Mar. 7-Apr. 27, for a total of 14 lightcurves at longitudes 197 – 185 degrees. Equally good fits are provided by a monomodal lightcurve of period 7.281 ± 0.001 h or a symmetric bimodal lightcurve of period 14.562 ± 0.001 h, both with an amplitude 0.08 ± 0.02 mag. The 7.281 h lightcurve is published here with the data binned into sets of 3 with a time difference no greater than 5 minutes to show a more readable lightcurve.

The large amplitudes observed by Debehogne and Zappala (1980) and by Harris and Young (1989) rule out a quadrimodal 14.56 h period. The new observations rule out the 10.90 h period allowed

by the data of Carlsson and Lagerkvist (1983). The only period consistent with all available observations is the one near 7.28 h, which we consider secure. Several other asteroids have shown similar characteristics with their lightcurves, i.e., bimodal, large-amplitude near equatorial aspects and monomodal, small-amplitude near polar aspect. Examples of such behavior can be found for 6249 Jennifer (Warner et. al. 2006) and 35 Leukothea (Pilcher 2008).

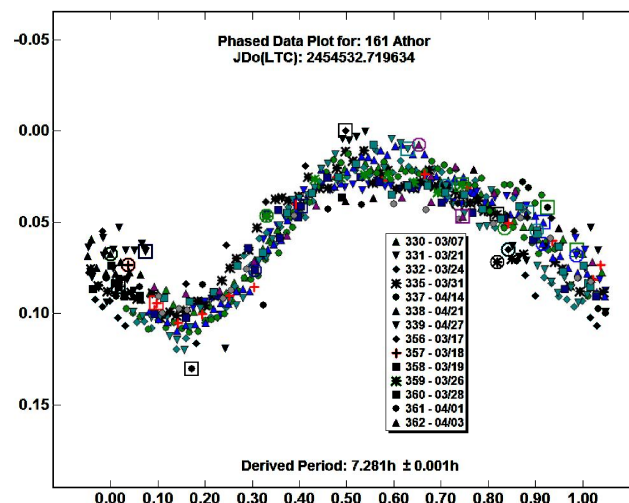
The observations in this study at longitudes 197-185 degrees and by Carlsson and Lagerkvist (1983) at longitude 153 degrees have almost identical lightcurve shapes and amplitudes. We consider these to be on opposite sides of the rotational pole and place the pole near longitude 170 degrees or 350 degrees. The latitude of the pole is poorly constrained but probably within 30 degrees of the ecliptic. This pole then places the 0.25 to 0.27 magnitude amplitude observations by Debehogne and Zappala (1980) at longitude 239 degrees and by Harris and Young (1989) at longitude 59-52 degrees, on opposite sides of the sky and near equatorial aspect.

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LIGHTCURVE ANALYSIS OF 788 HOHENSTEINA

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A collaborative effort from two widely-separated geographical longitudes resulted in three nights of long, continuous observations of 788 Hohensteina. The 14-hour, non-overlapping lightcurve allowed us to constrain the synodic period of the asteroid to 37.176 ± 0.004 h with an amplitude of 0.18 ± 0.03 mag.

Kingsgrove Observatory used a 0.25-m Schmidt-Cassegrain telescope operating at f/5.2 combined with an ST-402ME SBIG CCD camera at 1x1 binning, which gave a pixel scale of 1.40 arc seconds/pixel. All images were unfiltered and 60 s. *MPO Canopus* v.9.4.0.1 software was used for period analysis, which incorporates the Fourier algorithm developed by Harris (1989). Egan Observatory used 0.40-m Ritchey-Chretien telescope operating at f/5.6 on a Paramount ME mount coupled with an Apogee AP7ap back-illuminated camera. This produced a pixel resolution of 2.2 arc seconds/pixel.

788 Hohensteina, a 103-km C-class main-belt asteroid, was listed on the CALL website (Warner 2008) for further improvement in its known synodic period, the quality of which was listed as $U = 1+$ at the time (Harris and Warner 2008). Previous photometry by Behrend (2008) showed that the period was either 18.435 h or 28.85 h based on two short-duration lightcurves obtained by single observers.

A call for collaborative work was posted on the CALL website after initial data by Oey indicated a difficult, low-amplitude, and slow-rotating asteroid. Fauerbach responded and agreed to assist. From the five nights collected by Fauerbach and 18 nights collected by Oey, there were three nights, May 7, 10, and 14, that each formed a nearly continuous 14-hour lightcurve segment. The segments were not overlapping, being separated by about 2.5 hours. No attempt was made to standardize the zero point of the differential magnitudes. Instead, the data were aligned visually such that tail of the first segment made a reasonable fit with the head of the second segment. This method was deemed sufficiently reliable due to the low amplitude and long period nature of the object. All the data taken initially indicated that the lightcurve amplitude did not exceed 0.10 mag. With no collaboration, this alone could have led the authors to believe that the lightcurve period was approximately that reported by Behrend. However, the session on May 14 showed that the minimum amplitude should be 0.18 mag or more. Based on that assumption, the zero points were adjusted such that data on May 14 represented one minimum and the data from May 7 and 10 represented the second minimum, all the while keeping the overall amplitude at about 0.18 mag. Once the best fit period was obtained by inspection of the period spectrum, the remaining sessions were gradually added to the

lightcurve with the net result being the lightcurve presented here, phased to a synodic period of 37.176 ± 0.004 h.

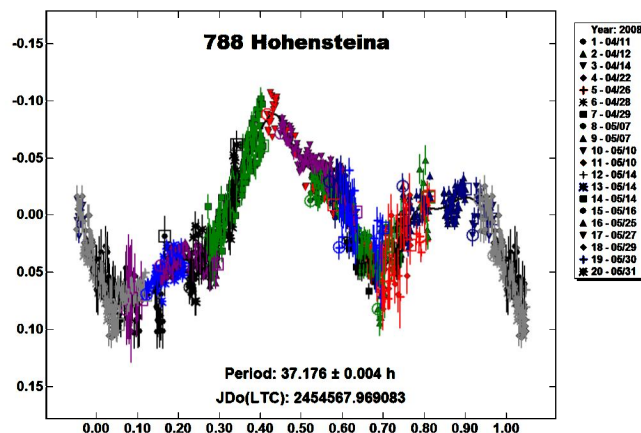
There was also an indication of Non-principal axis rotation (NPA or “tumbling”) as suggested by Alan Harris (private communications). Further observations are needed to confirm that possibility.

Acknowledgement

We would like to thank Brian Warner for his effort in helping to decipher the possible period presented from the available data.

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Sessions	Observer	Phase	LPAB	BPAB
1-7	Oey	9.2-5.5	219	12
9, 11, 14, 15, 18, 19, 20	Oey	6.3-13.1	220	13
8, 10, 12, 13, 16, 17	Marks, Fauerbach	6.5-12.5	220	13